

DIGITAL INFORMATION RECORDING/REPRODUCING APPARATUS

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation application of U.S. application Serial No. 10/277,830, filed October 22, 2002, which is a continuation of U.S. Serial No. 09/809,047, filed March 16, 2001, now U.S. Patent No. 6,498,691, which is a continuation application of U.S. application Serial No. 09/654,962, filed September 5, 2000, now U.S. Patent No. 6,324,025, which is a continuation of U.S. Serial No. 09/567,005, filed May 9, 2000, now U.S. Patent No. 6,278,564, which is a continuation application of U.S. Serial No. 09/326,595, filed June 7, 1999, now U.S. Patent No. 6,069,757, which is a continuation of U.S. application Serial No. 09/188,303, filed November 10, 1998, now U.S. Patent No. 6,002,536, which is a continuation of U.S. application Serial No. 08/917,176, filed August 27, 1997, now U.S. Patent No. 5,862,004, which is a continuation of U.S. application Serial No. 08/620,879, filed March 22, 1996, now U.S. Patent No. 5,699,203, and copending with U.S. application Serial No. 08/620,880, filed March 22, 1996, now U.S. Patent No. 5,673,154, which are continuations of U.S. application Serial No. 08/457,597, filed June 1, 1995, now U.S. Patent No. 5,530,598, which is a continuation of U.S. application Serial No. 08/457,486, filed June 1, 1995, now U.S. Patent No. 5,517,368, which is a continuation of U.S. application Serial No. 08/238,528, filed May 5, 1994, now U.S. Patent No. 5,671,095, which is a divisional of U.S. application Serial No. 07/727,059, filed July 8, 1991, now U.S. Patent No. 5,337,199, the subject matter of which are incorporated by reference herein.

1 BACKGROUND OF THE INVENTION

The present invention relates to a system for transmitting a digital video signal and recording the received video signal. More particularly, the present invention relates to great extension of the range of use of a digital signal recording/reproducing system by greatly shortening a recording time through transmission of a video signal in a compressed form, and further relates to great extension of the range of use of a digital signal recording/reproducing system by making the number of signals to be recorded and a recording/reproducing time variable.

As a digital magnetic recording/reproducing system (hereinafter referred to as VTR) is conventionally known, for example, a D2 format VTR. In such a conventional digital VTR, the elongation or shortening of a reproducing time is possible by using variable-speed reproduction. However, the prior art reference does not at all disclose high-speed recording in which a recording time is shortened to 1/m, multiple recording in which a plurality of signals are recorded, and the compression/expansion of a recording/reproducing time.

The above-mentioned conventional digital VTR has a feature that a high quality is attained and there is no deterioration caused by dubbing. However, the

1 shortening of a dubbing time is not taken into consider-
ation. Therefore, for example, in the case where a two-
hour program is to be recorded, two hours are required.
Thus, there is a drawback that inconveniences are
5 encountered in use. Also, the multiplexing of recording
signals is not taken into consideration. Therefore, for
example, when two kinds of programs are to be simul-
taneously recorded or reproduced, two VTR's are
required. This also causes inconveniences in use.

10 SUMMARY OF THE INVENTION

An object of the present invention is to
provide a digital VTR in which high-speed recording onto
a tape can be made with the same format as that used in
standard-speed recording, to provide a transmission
15 signal processing system for transmitting at a high
speed a video signal to be recorded by such a digital
VTR, and to extend the range of use of the digital VTR
by shortening a recording time. For example, the
digital VTR can be used in such a manner that a two-hour
20 program is recorded in about ten minutes and is
reproduced at a standard speed.

The above object is achieved as follows. A
video signal and an audio signal are subjected to time-
base compression to $1/m$, bit compression to $1/n$,
25 addition of a parity signal and modulation, and are
thereafter transmitted or outputted. The transmitted
signal is received, is subjected to demodulation, error

1 correction, addition of a parity signal and modulation,
and is thereafter recorded, onto a magnetic tape which
travels at a travel speed m times as high as that upon
normal reproduction, by use of a magnetic head on a
5 cylinder which rotates at a frequency m times as high as
that upon normal reproduction. The signal on the
magnetic tape traveling at a travel speed upon normal
reproduction is reproduced by a magnetic head on the
cylinder which rotates at a frequency upon normal
10 reproduction. The reproduced signal is subjected to
demodulation, error correction, bit expansion of video
and audio signals and D/A conversion, and is thereafter
outputted. Address signals corresponding to a plurality
of VTR's may be transmitted prior to a signal to be
15 recorded. Further, control signals indicative of the
start of recording and the stop of recording may be
transmitted. The transmitted signals are received and
error-corrected, and controls of the standby for
recording, the start of recording and the stop of
20 recording are made on the basis of the control signals.

With the above construction, since the video
signal and the audio signal are time-base compressed to
 $1/m$ and bit-compressed to $1/n$, a transmission time is
shortened to $1/m$ and a signal band turns to m/n . The
25 time-base compressed and bit-compressed signal is
transmitted after addition of a parity signal for error
correction and modulation to a code adapted for a
transmission path. The transmitted signal is received

1 and demodulated. The detection of an error produced in
a transmitting system and the correction for the error
can be made using the added parity signal. The error-
corrected signal is added with a parity signal for
5 correction for an error produced in a magnetic
recording/reproducing system and is modulated to a code
adapted for the magnetic recording/reproducing system.
Upon recording, since the rotation frequency of the
cylinder and the travel speed of the magnetic tape are
10 increased by m times, the recording onto the magnetic
tape can be made at an m -tuple speed. Upon reproduc-
tion, by setting the rotation frequency of the cylinder
and the travel speed of the magnetic tape to normal
ones, the reproduction at a normal speed can be made.
15 The reproduced signal is code-demodulated. The
detection of an error produced in the magnetic
recording/reproducing system and the correction for the
error can be made on the basis of the parity signal. By
bit-expanding the video signal and the audio signal
20 compressed by the transmission signal processing system,
the original video and audio signal can be restored.
The bit-expanded signal is converted into an analog
signal by a D/A converter. Simultaneous and selective
control of the start/stop of recording for a multi-
25 plicity of VTR's can be made in such a manner that the
address signals corresponding to the VTR's are
transmitted prior to a signal to be recorded, the
correction for an error of the received signal is made,

1 required VTR's are brought into recording standby
conditions by the corrected address signals, and
the controls of the start of recording and the stop
of recording are made by the transmitted control
5 signals.

Another object of the present invention is to
provide a digital signal recording/reproducing system in
which multiple recording onto a tape can be made with
the same format as that used in standard recording and
10 simultaneous multiple reproduction is possible, and to
extend the range of use of a digital VTR by compressing/
expanding a recording/reproducing time in accordance
with the transmission rate of a multiplexed input/output
signal and the number of signals in the multiplexed
15 input/output signal.

This object is achieved as follows. There are
provided means for selecting one or plural desired
signals from a time-base compressed and time-division
multiplexed digital input signal, and helical scan
20 recording means for making time-division multiplex
recording of the selected signals with a time-base
compressed speed after selection being retained. There
is further provided means for reproducing the recorded
signals with the rotation speed of a cylinder, a tape
25 speed and so on being set to values proportional to the
transmission rate of a reproduction signal and the
number of signals to be simultaneously reproduced and
with the signal being time-base expanded or being

1 retained as time-base compressed.

With the above construction, N kinds of
desired signals selected from the multiplexed input
digital signal and time-base compressed to $1/K$ are
5 subjected to time-division multiplex recording with a
time-base compressed speed after selection being
retained. Upon reproduction, for example, if both
the cylinder rotation speed and the tape speed are
set to N/K times, a recording track and a reproducing
10 track coincide with each other and the use of a
reproducing time K/N times as long as a recording
time enables the reproduction of each of the N kinds
of signals at a standard speed. Also, if both the
cylinder rotation speed and the tape speed are set to
15 $(M \times N)/K$ times, a recording track and a reproducing
track coincide with each other and the use of a
reproducing time as $K/(M \times N)$ times as long as the
recording time enables the reproduction of each of
the N kinds of signals at an M -tuple speed. In the
20 case where L kinds of signals are selected from among
the N kinds of reproduced signals and a processing
speed at a reproduction signal processing circuit is
set to $L \times M$ times as long as a standard reproduction
processing speed, each of the L kinds of signals among
25 the N kinds of multiple-recorded signals is outputted
at a speed M times as high as a standard speed.

1 BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of a digital transmission signal processing system and a recording/reproducing system according to an embodiment of the present invention;

Fig. 2 is a block diagram of a recording/reproducing system according to another embodiment of the present invention;

Fig. 3 is a diagram for explaining the conventional parity adding method;

Fig. 4 is a block diagram of a recording/reproducing system according to still another embodiment of the present invention;

Fig. 5 is a block diagram of a digital transmission signal processing system and a recording/reproducing system according to a further embodiment of the present invention;

Fig. 6 shows the format of control signals used in one of applications of the present invention;

Fig. 7 is a block diagram of a still further embodiment of the present invention;

Fig. 8 shows one example of the specification of signals to be recorded;

Fig. 9 is a block diagram of a furthermore embodiment of the present invention;

Figs. 10, 11 and 12 are block diagrams of different examples of applications of the present invention;

1 Fig. 13 is a block diagram for explaining one
example of the operation of the embodiment shown in
Fig. 7;

 Fig. 14 is a timing chart showing the
5 waveforms of signals involved in the example shown in
Fig. 13;

 Fig. 15 is a block diagram for explaining
another example of the operation of the embodiment shown
in Fig. 7;

10 Fig. 16 is a timing chart showing the
waveforms of signals involved in the example shown in
Fig. 15;

 Fig. 17 is a table showing some applications
of the examples shown in Figs. 13 and 15;

15 Fig. 18 is a block diagram of a still
furthermore embodiment of the present invention; and

 Figs. 19 and 20 are signal diagrams for
explaining different operations of the embodiment shown
in Fig. 18.

20 DESCRIPTION OF THE PREFERRED EMBODIMENTS

 An embodiment of the present invention will
now be explained by use of Fig. 1. In the figure,
reference numerals 1 and 40 denote magnetic tapes,
numerals 2, 3, 41 and 42 magnetic heads, numerals 4 and
25 43 cylinders, numerals 5 and 44 capstans, numerals 10
and 50 servo control circuits, numerals 20, 31 and 60
demodulation circuits, numerals 21, 32 and 61 error

1 correction circuits, numerals 22 and 23 compression
circuits, numerals 24 and 33 parity addition circuits,
numerals 25 and 34 modulation circuits, numerals 26 a
transmission circuit, numeral 27 a transmission path,
5 numeral 30 a reception circuit, numerals 62 and 63
expansion circuits, numerals 64 and 65 D/A conversion
circuits, numeral 70 a video signal output terminal, and
numeral 71 an audio signal output terminal.

Firstly, the operation of a transmission
10 signal processing system will be explained. Digital
video and audio signals recorded on the magnetic tape 1
are reproduced by the magnetic heads 2 and 3 mounted on
the cylinder 4 and are inputted to the demodulation
circuit 20. The magnetic tape 1 travels by virtue of
15 the capstan 5. The travel speed of the magnetic tape 1
and the rotation frequency of the cylinder 4 are, for
example, ten times as high as the tape travel speed and
the cylinder rotation speed upon normal reproduction.
Accordingly, the signal inputted to the demodulation
20 circuit 20 is a signal time-compressed to one tenth.
For example, a 120-minute signal recorded on the
magnetic tape 1 can be reproduced in 12 minutes.

Generally, in the case where a digital signal
is to be recorded on a magnetic recording medium, the
25 signal is recorded after having been modulated into
scrambled NRZ code, M² code or the like. The
demodulation circuit 20 performs a demodulation
processing, that is, a signal processing for restoring

1 the thus modulated signal into original digital data.
The signal demodulated by the demodulation circuit 20 is
inputted to the error correction circuit 21 in which
erroneous data produced in a magnetic recording/
5 reproducing process is detected and the correction for
the erroneous data is made. Further, the signal is
separated into a video signal and an audio signal which
are in turn inputted to the compression circuits 22 and
23, respectively. The video signal is bit-compressed
10 through, for example, discrete cosine conversion. The
audio signal is bit-compressed through, for example,
non-linear quantization or differential PCM. As a
result, the transmission rate of the video signal and
the audio signal in total is reduced to, for example,
15 one twentieth.

Output signals of the compression circuits 22
and 23 are inputted to the parity addition circuit 24
for performing a signal processing which includes adding
a parity signal for error correction and outputting the
20 video signal and the audio signal serially in accordance
with a transmission format. A serial output signal of
the parity addition circuit 24 is inputted to the
modulation circuit 25. In the modulation circuit 25,
the serial signal is modulated in accordance with the
25 characteristic and the frequency band of the transmis-
sion path 27. For example, in the case where the signal
is transmitted in an electric wave form, quadruple phase
shift keying (QPSK) is made. The modulated signal is

1 inputted to the transmission circuit 26 from which it is
outputted to the transmission path 27.

As apparent from the foregoing explanation of
the operation of the transmission signal processing
5 system, it is possible to transmit a signal at a speed
which is ten times as high as a normal speed.

The above embodiment has been shown in con-
junction with the case where a signal from the VTR is
reproduced. However, a signal source is not limited to
10 the VTR and may include a magnetic disk device, an
optical disk device or the like.

Next, explanation will be made of the
operation of the VTR for receiving and recording the
transmitted signal. The signal transmitted from the
15 transmission signal processing system is received by the
reception circuit 30. The received signal is inputted
to the demodulation circuit 31. The demodulation
circuit 31 is provided corresponding to the modulation
and demodulates the signal to the original signal. The
20 demodulated signal is inputted to the error correction
circuit 32 in which the detection of and the correction
for an error produced in the transmission path 27 are
made on the basis of the parity signal added by the
parity addition circuit 24. At this time, in the case
25 where the S/N ratio of the transmission system is not
sufficient so that complete correction for the error is
impossible, correction is made through, for example,
signal replacement, by use of the signal correlation.

1 An output signal of the error correction
circuit 32 is inputted to the parity addition circuit
33. In the parity addition circuit 33, a parity signal
for detecting an error produced in a recording/
5 reproducing process and making correction for the error
is added. The parity-added signal is inputted to the
modulation circuit 34. In the modulation circuit 34,
the signal is modulated to scrambled NRZ code, M² code
or the like as mentioned above. The modulated signal is
10 recorded on the magnetic tape 40 by the magnetic heads
41 and 42 mounted on the cylinder 43.

 Since the signal supplied to the magnetic
heads 41 and 42 is a signal which is time-base
compressed to one tenth as compared with a signal upon
15 normal operation, the servo control circuit 50 controls
the cylinder 43 and the capstan 44 so that the rotation
frequency of the cylinder 43 and the travel speed of the
magnetic tape 40 become ten times as high as those upon
normal recording. Also, in order to record a predeter-
20 mined signal at a predetermined position on the magnetic
tape 40, synchronization information is detected from
the received signal to control the phase of rotation of
the cylinder 41 on the basis of the detected synchro-
nization information.

25 Next, the operation of the VTR for reproducing
the thus recorded signal will be explained. Upon
reproduction, the travel speed of the magnetic tape 40
and the rotation frequency of the cylinder 43 are set to

1 those upon normal reproduction. The reproduced signal
is inputted to the demodulation circuit 60. The
demodulation circuit 60 is provided corresponding to the
modulation circuit 34 and demodulates the modulated
5 signal. The demodulated signal is inputted to the error
correction circuit 61 in which the detection of an error
produced in the magnetic recording/reproducing system
and the correction for the error are made on the basis
of the parity signal added by the parity addition
10 circuit 33. In the case where there is an error which
cannot be corrected, the error is properly corrected by
use of the signal correlation. Also, the signal is
outputted after having been separated into a video
signal and an audio signal.

15 The video signal is inputted to the expansion
circuit 62. The expansion circuit 62 is provided
corresponding to the compression circuit 22 and restores
the compressed video signal into the original video
signal. An output signal of the expansion circuit 62 is
20 inputted to the D/A conversion circuit 64 and is
converted thereby into an analog video signal which is
in turn outputted from the terminal 70.

 The audio signal is inputted to the expansion
circuit 63. The expansion circuit 63 is provided
25 corresponding to the compression circuit 23 and restores
the compressed audio signal into the original audio
signal. An output signal of the expansion circuit 63 is
inputted to the D/A conversion circuit 65 and is

1 converted thereby into an analog audio signal which is
in turn outputted from the terminal 71.

In the foregoing, the embodiment of the
present invention has been shown and the operation
5 thereof has been explained. According to the present
invention, a video signal and an audio signal over a
long time can be transmitted and recorded in a short
time, thereby making it possible to extend the range of
use of the digital VTR.

10 Another embodiment of the present invention is
shown in Fig. 2. Fig. 2 is partially similar to Fig. 1.
The same parts in Fig. 2 as those in Fig. 1 are denoted
by the same reference numerals as those used in Fig. 1
and detailed explanation thereof will be omitted. The
15 embodiment shown in Fig. 2 concerns a VTR in which a
signal transmitted/received at a high speed can be
recorded while being monitored.

In Fig. 2, reference numeral 80 denotes a
change-over switch, numeral 81 an error correction
20 circuit, and numeral 82 a memory circuit. An error-
corrected video signal outputted from the error correc-
tion circuit 81 is inputted through the memory circuit
82 to a terminal R side of the change-over switch 80
which is selected upon recording. The memory circuit 82
25 has a memory capacity for at least one field. The video
signal received at a high speed is stored into a memory
of the memory circuit 82 with the number of frames being

1 reduced. The stored signal is read from the memory at a normal speed and is inputted to an expansion circuit 62.

Upon reproduction, a video signal output of an error correction circuit 61 is inputted to a terminal P
5 side of the change-over switch 80 which is selected upon reproduction. Accordingly, the operation of the embodiment of Fig. 2 upon reproduction is similar to that of the embodiment shown in Fig. 1.

In the embodiment shown in Fig. 2, upon
10 recording, the video signal outputted from the error correction circuit 81 is inputted to the expansion circuit 62 through the memory circuit 82. Alternatively, an output signal of a modulation circuit 34 may be inputted to a demodulation circuit 60 through a memory
15 circuit. Also, in the case where the operating speed of the demodulation circuit 60 or the error correction circuit 61 leaves a margin, a memory circuit may be properly placed at a post stage. Or, in the case where the storage capacity of the error correction circuit 61
20 or the expansion circuit 62 leaves a margin, the circuit may be used as a memory circuit or any additional memory circuit may be omitted.

As has been explained in the above, the
embodiment shown in Fig. 2 makes it possible to record a
25 received video signal while monitoring it in the form of a picture having a reduced number of frames.

In the embodiment shown in Fig. 1, the parity signal is added in order to make the detection of and

1 the correction for an error which may be produced in the
transmission system or the magnetic recording/reproduc-
ing system. One example of a parity adding method is
shown in Fig. 3 in conjunction with the case of a D2
5 format VTR. In the D2 format VTR, a signal for one
field is divided into a plurality of segments for signal
processing. Fig. 3 shows one segment. In Fig. 3,
reference numeral 90 represents a group of video data,
numeral 91 a group of outer code parities, and numeral
10 92 a group of inner code parities. Firstly, outer code
parities are added for data of the matrix-like arranged
video data group 90 which lie in a vertical direction in
Fig. 3. Thereafter, inner code parities are added for
data of the video data group 90 and the outer code
15 parity group 91 lying in a horizontal direction in Fig.
3, thereby producing a signal to be recorded. Though
detailed explanation of the generation of parities will
be omitted herein, the parities are generated in
accordance with a generating function $G(x)$.

20 In the embodiment shown in Fig. 1, if the same
parity generation manner is employed by the parity
addition circuits 24 and 33, the error correction
circuits 32 and 61 may hold the most part thereof in
common. Namely, since the error correction circuits 32
25 and 61 are circuits which are respectively used upon
recording and upon reproduction, it is possible to
reduce the circuit scale or size by using the most part
of the circuits 32 and 61 in common.

1 Further, in the case where the same parity
generation manner is employed by the parity addition
circuits 24 and 33 in the embodiment shown in Fig. 1, it
is possible to further reduce the circuit scale or size
5 of the recording/reproducing system. The construction
in that case is shown in Fig. 4 as still another embodi-
ment of the present invention. Fig. 4 is partially
common to Fig. 1 or 2. The parts in Fig. 4 common to
those in Fig. 1 or 2 are denoted by the same reference
10 numerals as those used in Fig. 1 or 2 and detailed
explanation thereof will be omitted.

The embodiment shown in Fig. 4 is based on a
concept that an error produced in a transmission system
and an error produced in a magnetic recording/reproduc-
15 ing system are simultaneously detected and corrected by
an error correction circuit 61. Accordingly, a signal
received by a reception circuit 30 is demodulated by a
demodulation circuit 31 and is inputted to a modulation
circuit 34 without being subjected to error correction
20 and parity addition. The subsequent processing is the
same as that in the embodiment shown in Fig. 1 or 2.
Namely, a reproduced signal is inputted to the error
correction circuit 61 after demodulation by a demodula-
tion circuit 60. As mentioned above, an error produced
25 in the transmission system and an error produced in the
magnetic recording/reproducing system are simultaneously
detected and corrected by the error correction circuit
61 in the reproducing system.

1 In the embodiment shown in Fig. 4, the error
correction circuit 32 and the parity addition circuit 33
can be removed as compared with the embodiment shown in
Fig. 1 or 2, thereby making it possible to reduce the
5 circuit scale.

 Though having not been mentioned in the
foregoing embodiments, in a helical scan VTR as shown,
since a signal becomes discontinuous when a track jump
is made upon reproduction, the recording is made with an
10 amble signal being added to the heading portion of a
signal. Since the addition of an amble signal is
employed in the D2 format VTR, detailed explanation
thereof will be omitted. Also, in order to define a
starting position of a signal, a synchronizing signal is
15 properly added. Since the addition of a synchronizing
signal is known in, for example, the D2 format VTR,
detailed explanation thereof will be omitted.

 In the embodiment shown in Fig. 1, the
addition of an amble signal may be made by the parity
20 addition circuit 24. Alternatively, it may be made on
the recording/reproducing system side in order to
enhance the efficiency of use of the transmission path
27. In this case, the addition of an amble signal can
be made by the parity addition circuit 33. As for the
25 embodiment shown in Fig. 4, in the case where the
addition of an amble signal is to be made on the
recording/reproducing system side, the amble signal can
be added by the modulation circuit 34. In the case

1 where the addition of an amble signal is made on the
recording/reproducing system side, it is possible to
enhance the efficiency of use of the transmission path
27. On the other hand, in the case where the addition
5 of an amble signal is made on the transmission signal
processing system side, the lowering of the cost of a
VTR can be attained as a great effect when a signal is
sent to a multiplicity of VTR's simultaneously.

Fig. 5 shows a further embodiment of the
10 present invention in which the further reduction of the
circuit scale of a VTR on the receiving side and hence
the further lowering of the cost can be attained in the
case where a signal is sent to a multiplicity of VTR's
simultaneously.

15 Fig. 5 is partially common to Fig. 1, 2 or 4.
The parts in Fig. 5 common to those in Fig. 1, 2 or 4
are denoted by the same reference numerals as those used
in Fig. 1, 2 or 4 and detailed explanation thereof will
be omitted. In Fig. 5, reference numeral 100 denotes a
20 modulation circuit. The embodiment shown in Fig. 5 is
based on a concept that a signal processing required
upon a recording mode of a VTR is performed on the
transmitting side. Namely, modulation adapted for
magnetic recording/reproduction, for example, a signal
25 processing corresponding to the modulation circuit 34
shown in Fig. 4 is performed on the transmission signal
processing system side. After parities have been added
by a parity addition circuit 24 of the transmission

1 signal processing system, the modulation adapted for the
magnetic recording/reproduction is performed by the
modulation circuit 100. Therefore, modulation adapted
for transmission is performed by a modulation circuit
5 25. As a modulation system employed by the modulation
circuit 100 is suitable a system which does not cause
the extension of a frequency band by modulation, for
example, scrambled NRZ. A signal modulated by the
modulation circuit 25 is transmitted to a transmission
10 path 27 through a transmission circuit 26 in a manner to
that in the embodiment shown in Fig. 1.

The signal received by a reception circuit 30
through the transmission path 27 is inputted to a
demodulation circuit 31 in which the signal is subjected
15 to demodulation corresponding to the modulation circuit
25. Since the signal demodulated by the demodulation
circuit 31 is one which has already been subjected by
the modulation circuit 10 to the modulation adapted for
the magnetic recording/reproduction, the signal is
20 recorded on a magnetic tape 40 by magnetic heads 41 and
42 as it is. As a result, the same recording as that in
the embodiment shown in Fig. 4 is made. An operation
upon reproduction is similar to that in the embodiment
shown in Fig. 4.

25 As apparent from the above, the present
embodiment makes it possible to remarkably reduce the
circuit scale of the VTR.

1 According to one of applications of the
present invention, it is possible to transmit a signal
from a transmission signal processing system to a
multiplicity of VTR's through a transmission path
5 simultaneously and at a high speed, as has already been
mentioned. In this case, it is difficult to control a
multiplicity of 'VTR's simultaneously. Further, it is
required to make a control which causes specified ones
of the VTR's to perform recording operations and
10 specified others of the VTR's not to perform recording
operations. A technique for realizing such a control
will be shown just below.

For the above purpose, control signals are
transmitted prior to transmission of a signal to be
15 recorded. One example of the control signals is shown
in Fig. 6. In the figure, reference numeral 110 denotes
a synchronizing signal, numeral 111 an ID signal
indicative of a control to be made, numeral 112 an
address signal indicative of a VTR to be controlled,
20 numeral 113 a control signal for bringing a VTR
designated by the address signal 112 into a recording
mode, numeral 114 a control signal for stopping the
recording, numerals 115 and 116 blank signals, and
numeral 120 a recording signal to be actually recorded.

25 The ID signal 111 indicating the transmission
of the address signals 112 indicative of VTR's in which
a signal is to be recorded, is transmitted at a
predetermined position relative to the synchronizing

1 signal 110 to bring each VTR into a standby condition.
After all the address signals have been transmitted, the
ID signal 113 is transmitted to start the recording of
the signal 120 in the designated VTR's. After the
5 signal 120 has been transmitted, the ID signal 114 to
control the stop of recording is transmitted. Each of
the blank signals 115 and 116 is a signal for conforming
a signal transmission format to the other transmission
signal and is therefore an insignificant signal portion.

10 In the embodiments shown in Figs. 1 and 5,
those control signals are produced by a control signal
generation circuit 130 and are transmitted with parities
which are added by the parity addition circuit 24 for
making correction for an error produced during trans-
15 mission.

In the VTR shown in Fig. 1, the control
signals are detected by a control circuit 131 after the
reception by the reception circuit 30, the demodulation
by the demodulation circuit 31 and the correction by the
20 error correction circuit 32 for an error produced during
transmission to make a control for the recording and the
stop of recording in the recording/reproducing system.

In the case of the VTR's shown in Figs. 4 and
5, an output signal of the demodulation circuit 31 is
25 inputted to the error correction circuit 61 for a need
of making correction for an error produced during
transmission and error-corrected control signals are
inputted to a control circuit 131. In a change-over

1 circuit 132, the terminal R side for selecting an output
signal of the demodulation circuit 31 is selected upon
recording and the terminal P side for selecting an
output signal of the demodulation circuit 60 is selected
5 upon reproduction.

As apparent from the foregoing, the present
embodiment makes it possible to control a multiplicity
of VTR's selectively and simultaneously.

Also, the use of the change-over circuit 132
10 and a memory circuit makes it possible to record a
signal while monitoring it in the form of a picture
having a reduced number of frames, as explained in
conjunction with the embodiment shown in Fig. 2.

Next, a still further embodiment of the
15 present invention will be explained by use of Fig. 7.
In the figure, reference numeral 301 denotes an input
terminal for standard analog video signal, numeral 302
an input terminal for standard digital video signal,
numeral 303 an input terminal for high-speed digital
20 video signal, numeral 305 a recording system mode
change-over switch, numeral 306 a recording system
change-over signal generation circuit, numeral 310 an
A/D converter, numeral 320 a change-over circuit,
numeral 330 a data compression circuit, numeral 340 a
25 change-over circuit, numeral 350 a recording system
signal processing circuit for performing a signal
processing which includes addition of error correction
code and modulation for recording, numeral 370 a

1 cylinder, numeral 371 a magnetic tape, numerals 372 and
372' magnetic heads, numeral 380 a reproducing system
signal processing circuit for performing a signal
processing which includes demodulation for reproduction,
5 error detection and error correction. Numeral 390 a
change-over circuit, numeral 400 a data expansion
circuit, numeral 420 a D/A converter, numeral 431 an
output terminal for standard analog video signal,
numeral 432 an output terminal for standard digital
10 video signal, numeral 433 an output terminal for high-
speed digital video signal, numeral 435 a reproducing
system mode change-over switch, and numeral 436 a
reproducing system change-over signal generation
circuit.

15 The present embodiment is an example of a
digital magnetic recording/reproducing system which has
recording modes of standard-speed recording and high-
speed recording and reproduction modes of standard-speed
reproduction and high-speed reproduction. Fig. 8 shows
20 one example of the specification of input video signals.

 Firstly, explanation will be made of standard-
speed recording. A digital signal into which an analog
video signal inputted from the input terminal 301 is
converted by the A/D converter 310 or an equivalent
25 digital signal which is inputted from the input terminal
302, is switched or selected by the change-over circuit
320, is subjected to a predetermined data compression
processing by the data compression circuit 330 and is

1 thereafter inputted to a terminal 340a of the change-
over circuit 340. In the change-over circuit 340, a
change-over to connect the terminal 340a and a terminal
340c is made by a change-over signal from the recording
5 system change-over signal generation circuit 306.
Thereby, the data-compressed signal is inputted to the
recording system signal processing circuit 350. In the
recording system signal processing circuit 350, a signal
processing such as channel division, addition of error
10 correction code and modulation for recording is
performed at a predetermined processing clock adapted
for the data-compressed signal. Thereafter, the signal
is supplied to the magnetic heads 372 and 372' mounted
on the cylinder 370 so that it is recorded onto the
15 magnetic tape 371. The cylinder 370 and the magnetic
tape 371 are controlled by a servo control circuit 360.
The servo control circuit 360 controls a cylinder motor
and a capstan motor so as to provide a cylinder rotation
speed and a tape speed for standard speed and so as to
20 be synchronized with the input video signal.

Next, explanation will be made of high-speed
recording. A high-speed digital video signal inputted
from the input terminal 303 is sent to a terminal 340b
of the change-over circuit 340. Since the high-speed
25 digital video signal is a signal which has already been
subjected to a data compression processing, it is not
necessary to pass the signal through the data
compression circuit 330. A change-over to connect the

1 terminal 340b and the terminal 340c is made by a change-
over signal from the recording system change-over signal
generation circuit 306 so that the high-speed digital
video signal is inputted to the recording system signal
5 processing circuit 350. In the recording system signal
processing circuit 350, a signal processing similar to
that in the case of the standard-speed recording is
performed at a predetermined processing clock adapted
for the high-speed digital video signal. Thereafter,
10 the signal is supplied to the magnetic heads 372 and
372' mounted on the cylinder 370 so that it is recorded
onto the magnetic tape 371. The cylinder 370 and the
magnetic tape 371 are controlled by the servo control
circuit 360. The servo control circuit 360 control the
15 cylinder motor and the capstan motor so as to provide a
predetermined cylinder rotation speed and a predeter-
mined tape speed and so as to be synchronized with the
input video signal.

In the present invention, the recording onto
20 the tape can be made with the quite same format in both
the standard-speed recording and the high-speed record-
ing, thereby making it possible to greatly shorten a
recording time in the high-speed recording mode.

Next, explanation will be made of a signal
25 processing upon reproduction. In the present embodi-
ment, the recording pattern on the magnetic tape is the
same whichever of the standard-speed recording and the
high-speed recording is selected as a recording mode.

1 Therefore, either standard-speed reproduction or high-speed reproduction can be selected irrespective of the recording mode.

Firstly, the standard-speed reproduction will
5 be explained. The servo control circuit 360 controls the cylinder motor and the capstan motor so that a cylinder rotation speed and a tape speed for standard speed are provided. A signal reproduced by the magnetic heads 372 and 372' is inputted to the reproducing system
10 signal processing circuit 380. In the reproducing system signal processing circuit 380, a signal processing such as demodulation for reproduction, channel synthesis, error detection and error correction is performed at a predetermined processing clock adapted
15 for the standard-speed reproduction. Thereafter, the signal is supplied to a terminal 390a of the change-over circuit 390. In the change-over circuit 390, a change-over to connect the terminal 390a and a terminal 390c is made upon standard-speed reproduction by a change-over
20 signal from the reproducing system change-over signal generation circuit 436. Thereby, the reproduced signal is supplied to the data expansion circuit 400. In the data expansion circuit 400, a signal processing reverse to the data compression processing upon recording is
25 performed so that the signal is restored to the original signal. Thereby, the original transmission rate is restored. The data-expanded reproduction signal is sent to the D/A converter 420 on one hand to be outputted as

1 an analog video signal from the output terminal 431
after D/A conversion and is sent to the output terminal
432 on the other hand to be outputted as a digital video
signal therefrom.

5 Next, explanation will be made of the high-
speed reproduction. The servo control circuit 360
controls the cylinder motor and the capstan motor so
that a predetermined cylinder rotation speed and a
predetermined tape speed adapted for the high-speed
10 reproduction are provided. A signal reproduced by the
magnetic heads 372 and 372' is inputted to the reproduc-
ing system signal processing circuit 380. In the
reproducing system signal processing circuit 380, a
signal processing such as demodulation for reproduction,
15 channel synthesis, error detection and error correction
is performed at a predetermined processing clocks
adapted for the high-speed reproduction. Thereafter,
the high-speed reproduction signal is supplied to the
terminal 390a of the change-over circuit 390. In the
20 change-over circuit 390, a change-over to connect the
terminal 390a and a terminal 390b is made upon high-
speed reproduction. Thereby, the high-speed digital
video signal is outputted from the output terminal 433.

 A furthermore embodiment of the present
25 invention will be explained by use of Fig. 9. The
construction of the present embodiment is similar to
that of the embodiment shown in Fig. 7 but is different
therefrom in that the change-over circuit 340 is placed

1 at a different position, the change-over circuit 390
used in Fig. 7 is eliminated and a change-over circuit
345 is newly added.

An input/output signal upon standard-speed
5 recording/reproduction in the present embodiment is the
same as that in the embodiment shown in Fig. 7. As for
high-speed recording and high-speed reproduction,
however, the present embodiment is different from the
embodiment of Fig. 7 in that the transmission of a high-
10 speed digital video signal is made in the form of a
recording format. Accordingly, upon high-speed
recording, the high-speed digital video signal is not
passed through a recording system signal processing
circuit 350 but is recorded onto a tape through the
15 change-over circuit 340 as it is. Upon high-speed
reproduction, a reproduced signal is subjected to a
signal processing for reproduction such as error
detection and error correction by a reproducing system
signal processing circuit 380 and is thereafter inputted
20 to a terminal 345b of the change-over circuit 345.
The signal supplied through the change-over circuit
345 to the recording system side signal processing
circuit 350 is subjected to a signal processing for
recording such as addition of error correction code and
25 modulation for recording by the signal processing
circuit 350 to form a recording format and is thereafter
outputted as a high-speed digital video signal from an
output terminal 433.

1 The embodiments shown in Figs. 7 and 9 have
feature that high-speed recording and high-speed
reproduction are possible. The best use of this feature
can be made for dubbing or data communication with the
5 result of effective shortening of a dubbing time, a data
communication time or a data circuit line occupation
time. Also, though those embodiments have been
mentioned in conjunction with an example in which all of
standard-speed recording, high-speed recording,
10 standard-speed reproduction and high-speed reproduction
modes are involved, it is not necessarily required to
implement all of those modes. There may be considered
an example in which only a necessary mode is provided in
compliance with the purpose of use. Fig. 10 shows an
15 embodiment in which a high-speed recording function is
provided as a recording mode and at least a high-speed
reproduction function is provided as a reproduction
mode. Also, there may be considered an embodiment as a
system for the exclusive use for reproduction in which
20 at least a high-speed reproduction function is provided,
as shown in Fig. 11. Further, Fig. 12 shows an embodi-
ment in which a high-speed recording function is
provided as a recording mode and a standard-speed
reproduction function is provided as a reproduction
25 mode.

Fig. 13 is a block diagram of one example of
the magnetic recording/reproducing system of the embodi-
ment of Fig. 7 for explaining processings subsequent to

1 the compression processing. In Fig. 13, reference
numeral 201 denotes a synchronization detection circuit,
numeral 204 a recording modulation circuit, numeral 205
a cylinder servo control circuit, numeral 206 a capstan
5 servo (or tape speed) control circuit, numeral 207 a
reproduction reference signal generation circuit,
numeral 210 a demodulation circuit, numeral 211 a
cylinder, numeral 212 a pair of recording heads, numeral
213 a pair of reproducing heads, numeral 214 a capstan
10 which controls the tape speed, numeral 215 a magnetic
tape, numeral 216 a delivery reel, and numeral 217 a
take-up reel. Fig. 14 is a timing chart of input and
output signals in the example shown in Fig. 13 and
schematically illustrate a compressed picture signal 251
15 which is an input signal, a synchronizing signal 252 of
the picture signal, a standard-speed reproduction signal
255 which is an output signal, and a reproduction
synchronizing signal 256.

In the shown example, n -tuple speed recording
20 is realized by making a tape speed and a cylinder rota-
tion speed upon recording n times as high as those upon
standard-speed reproduction. As shown in Fig. 14, the
compressed video signal as an input signal of the
circuit shown in Fig. 13 and the synchronizing signal
25 include information 251 for n pictures and n synchroniz-
ing pulses 252 synchronous therewith in a time when one
picture is reproduced at a standard speed. The picture
information is converted into a predetermined recording

1 format by the recording modulation circuit 204 and is
recorded onto the magnetic tape 215 by the recording
heads 212. At this time, a synchronizing signal for the
cylinder servo control circuit 205 and the capstan servo
5 control circuit 206 is increased by n times in
compliance with the n -tuple speed video signal, as shown
by 252 in Fig. 14, so that the rotation speed of the
cylinder 211 and the feed speed of the magnetic tape 215
are increased by n times. Thereby, the recording onto
10 the tape can be made with the quite same recording
format as that in the case of the standard-speed
recording. Upon reproduction, a synchronizing signal
for the cylinder servo control circuit 205 and the
capstan servo control circuit 206 is supplied from the
15 reproduction reference signal generation circuit 207 to
restore the cylinder rotation speed and the tape feed
speed to those upon standard-speed reproduction, and a
signal read by the reproducing heads 213 is demodulated
by the demodulation circuit 210 and is outputted
20 therefrom. In the circuit shown in Fig. 13, if the
input video signal and the synchronizing signal are ones
of standard speed, standard-speed recording is possible.
Also, n -tuple speed reproduction is possible if the
frequency of an output signal from the reproduction
25 reference signal generation circuit is increased by n
times.

Fig. 15 is a block diagram of another example
of the magnetic recording/reproducing system of the

1 embodiment of Fig. 7 for explaining processings sub-
sequent to the compression processing. Fig. 16 is a
timing chart of input and output signals in the example
shown in Fig. 15. In Fig. 15, the same reference
5 numerals as those used in Fig. 13 denote the same or
equivalent components as or to those shown in Fig. 13.
In Fig. 15, reference numeral 202 denotes a $\div m$ circuit,
numeral 203 recording system memories, numeral 208 a $\div m$
circuit, and numeral 209 reproducing system memories.
10 In Fig. 16, the same reference numerals as those used in
Fig. 14 denote the same or equivalent signals as or to
those shown in Fig. 14. In Fig. 16, reference numeral
253 denotes outputs of the recording system memories 203
and numeral 254 denotes an output of the $\div m$ circuit 208
15 or a synchronizing signal divided by m .

The embodiment shown in Fig. 15 is an example
in which m pairs of recording heads are used to simul-
taneously record magnetic signals for m pictures on m
tracks, thereby realizing high-speed recording while
20 suppressing an increase in the cylinder rotation speed.
Upon reproduction, m pairs of reproducing heads are
used. Though Fig. 15 shows the case where two pairs of
recording heads 212 are used to simultaneously record
information for two pictures on two tracks, three or
25 more pairs of heads can be used in a similar manner.

Fig. 17 is a table showing some examples of
the tape speed and the cylinder rotation speed (rpm) in
the embodiments shown in Figs. 13 and 15. In the table,

1 high-speed recording or reproduction at a speed ten
times as high as the standard speed is shown by way of
example. Design for implementing another high-speed
recording or reproduction is similarly possible. In the
5 table shown in Fig. 17, examples ①, ② and ③ correspond
to the embodiment shown in Fig. 13 and examples ④ and
⑤ correspond to the embodiment shown in Fig. 15.

A still furthermore embodiment of a digital
signal recording/reproducing system of the present
10 invention will be explained by use of a block diagram
shown in Fig. 18.

In Fig. 18, reference numeral 501 denotes a
signal input terminal to which a plurality of video
signals are inputted in a time-division multiplex form,
15 numeral 502 a recording selection signal input terminal
to which a recording selection signal for selecting one
or plural signals to be recorded from the multiplexed
input signal is inputted, numeral 503 a recording signal
selection circuit for selecting the signals to be
20 recorded from the multiplexed input signal in accordance
with the recording selection signal from the input
terminal 502, numeral 504 a recording signal processing
circuit for subjecting the selected signals to a digital
processing for recording onto a recording medium,
25 numerals 505 and 505' magnetic heads, numeral 506 a
rotating drum, numeral 507 a magnetic tape or the
recording medium, numeral 508 a servo circuit for
controlling the rotation of the drum 506 and the travel

1 of the tape 507, numeral 511 a reproduction selection
signal input terminal to which a reproduction selection
signal for selecting one or plural signals to be out-
putted as a reproduction signal from among the multiple-
5 recorded and reproduced signals is inputted, numeral 509
a reproduction signal selection circuit for selecting
the signals to be outputted as a reproduction signal
from among the multiple-recorded and reproduced signals
in accordance with the reproduction selection signal
10 from the input terminal 511, numeral 510 a reproduction
signal processing circuit for subjecting the selected
signals to a digital processing, and numeral 512 a
reproduction signal output terminal.

The time-division multiplexed input video
15 signal from the signal input terminal 501 is supplied to
the recording signal selection circuit 503. The
recording signal selection circuit 503 is also supplied
with the recording selection signal from the recording
selection signal input terminal 502 to make the selec-
20 tion of signals to be recorded. For example, in the
case where six kinds of video signals A, B, C, D, E and
F are inputted in a time-division multiplex form as
shown in (a) of Fig. 19 and four signals A, B, C and D
thereof are to be selected and recorded, an output of
25 the recording signal selection circuit 503 is as shown
in (b) of Fig. 19. Such an output signal of the
recording signal selection circuit 503 is inputted to
the recording signal processing circuit 504 which in

1 turn performs a signal processing for recording such as
addition of error correction code. Also, the recording
signal selection circuit 503 produces a speed control
signal on the basis of the number of signals in the
5 time-division multiplexed input video signal, the trans-
mission rate of the input signal and the number of
signals to be recorded which are selected by the record-
ing selection signal. The speed control signal is
supplied to the recording signal processing circuit 504
10 and the servo circuit 508. For example, in the case
where the input video signal is time-division multi-
plexed to sextuplet with each of six signals in the
multiplexed input signal being transmitted at a rate
time-base compressed to $1/6$ and four signals among the
15 six signals in the multiplexed input signal are to be
selectively recorded, a signal indicative of a quadruple
speed is produced as the speed control signal. Also, in
the case where the input video signal is time-division
multiplexed to sextuplet with each of six signals in the
20 multiplexed input signal being transmitted at a rate
time-base compressed to $1/12$ and four signals among the
six signals in the multiplexed input signal are to be
selectively recorded, a signal indicative of a octuple
speed is produced as the speed control signal. Namely,
25 in the case where an input signal is multiplexed to N-
plet, the compression rate of each of the N signals in
the multiplexed input signal is $1/K$ and the number of
signals to be selectively recorded is L, a speed control

1 signal indicative of an $(L \times K)/N$ -tuple speed is produced.
The operating speed of the recording signal processing
circuit 504 which processes a signal from the recording
signal selection circuit 503, is changed in accordance
5 with the speed control signal. For example, in the case
of a speed control signal indicative of a quadruple
speed, the recording signal processing circuit 504
performs a signal processing at a speed four times as
high as a normal speed and supplies the processed signal
10 to the magnetic heads 505 and 505'. Here, for example,
in the case where the input video signal is time-
division multiplexed to sextuplet with each of the six
signals in the multiplexed input signal being trans-
mitted at a rate time-base compressed to $1/6$ and a speed
15 control signal indicative of a quadruple speed is used
to selectively record four signals from among the six
signals, the speed of an input signal inputted to the
recording signal processing circuit 504 is four times as
high as that of one video signal having a normal speed
20 and the recording signal processing circuit 504 pro-
cesses this quadruple-speed input signal at a quadruple
speed and supplies the processed signal to the magnetic
heads, thereby making it possible to record all of the
four selected signals. Also, if the recording signal
25 selection circuit 503 is constructed so that signals to
be selectively recorded are sequentially changed for
every one track on the tape, compatibility can be held
in regard to the number of signals to be selectively

1 recorded and a processing speed by causing the recording
signal processing circuit 504 to perform a completed
processing for every one track. In the following,
explanation will be made in conjunction with the case
5 where each video signal is recorded in such a form
completed for every track. However, it should be noted
in advance that the present invention is applicable to
another recording system, for example, a system in which
signals are recorded in a form changed for every pixel,
10 line or field. On the other hand, the servo circuit 508
supplied with the speed control signal indicative of the
quadruple speed controls the rotation speed of the
rotating drum 506 so that it becomes four times as high
as a normal speed and the travel speed of the magnetic
15 tape 507 so that it becomes four times as high as a
normal speed. Thereby, four signals A, B, C and D are
alternately recorded on successive tracks of the
magnetic tape 507, as shown in Fig. 20. According to
the control mentioned above, the pattern of recording
20 tracks on the tape becomes the same irrespective of the
number of signals in the multiplexed input signal, the
transmission rate of each signal and the number of
signals to be selectively recorded. In order to make a
control upon reproduction easy, it is preferable that
25 the number of selectively recorded signals and the
identification codes or signal numbers thereof (for
example, A, B, C and D or 0, 1, 2 and 3) are recorded as
an ID signal for every track.

1 In the above example, the recording of the
time-division multiplexed signal has been mentioned.
However, it is needless to say that the present
invention is also applicable to the case where the
5 number of multipet signal components in an input video
signal is 1 or the input video signal is not multi-
plexed. In such a case, since the recording signal
processing circuit 504 and the servo circuit 508 operate
at speeds proportional to the transmission rate of the
10 input video signal, an effect is manifested, for
example, in high-speed dubbing. As apparent from the
foregoing explanation of the operation, it is of course
that a multiplexed signal can be recorded at a high
speed.

15 Upon reproduction, a signal reproduced from
the magnetic tape 507 by the magnetic heads 505 and 505'
mounted on the rotating drum 506 is inputted to the
reproduction signal selection circuit 509. The
reproduction signal selection circuit 509 produces a
20 speed control signal, for example, by detecting the
number of multiple-recorded signals from the ID signal
included in the reproduced signal and sends the speed
control signal to the servo circuit 508. The speed
control signal is a signal indicative of a speed four
25 times as high as the normal reproduction speed in the
case where the number of multiple-recorded signals is 4
and a signal indicative of a sextuple speed in the case
where it is 6. In the case of the quadruple speed, the

1 servo control circuit 508 supplied with the speed
control signal indicative of the quadruple speed
controls the rotation speed of the rotating drum 506 so
that it becomes four times as high as a normal speed and
5 the travel speed of the magnetic tape 7 so that it
becomes four times as high as a normal speed. Thereby,
there can be traced all of signals recorded so that the
recording track pattern on the tape becomes the same
irrespective of the number of signals to be selectively
10 recorded. In a system which has not a signal indicative
of the number of selectively recorded signals, there may
be employed a method in which the speed control signal
is manually set. In a system in which the number of
signals to be recorded on the tape is fixed, the speed
15 control signal has a fixed value. The reproduction
signal selection circuit 509 receives a reproduction
selection signal inputted from the reproduction
selection signal input terminal 511 to select a desired
signal(s) from among the signals reproduced by the
20 magnetic heads 505 and 505' and to output the selected
signal as a reproduction signal to the reproduction
signal processing circuit 510. The reproduction signal
selection circuit 509 also outputs a selection number
signal indicative of the number of selected signals to
25 the reproduction signal processing circuit 510.

The reproduction signal processing circuit 510
performs a signal processing such as code error correc-
tion processing and picture signal processing for the

1 reproduction signal at a processing speed corresponding,
to the selection number signal and outputs the processed
reproduction signal from the output terminal 512. For
example, in the case where the number indicated by the
5 selection number signal is 2, the signal processing
speed is two times as high as a normal speed and various
processings are performed for each selected signal. For
example, in the case where signals A and C are selected,
the signals A and C are outputted alternately for each
10 field. In the case where the number indicated by the
selection number signal is 1, for example, when the
reproduction selection signal from the reproduction
selection signal input terminal 511 selects only the
signal C, the reproduction signal processing circuit 510
15 performs the signal processing at the normal speed to
output the signal as reproduced at a normal speed. As
apparent from the above, the present embodiment makes it
possible to simultaneously record any number of signals
selected from among a plurality of signals in a multi-
20 plexed video signal and to simultaneously reproduce any
number of signals from among the recorded signals.

In the case where a plurality of signals are
simultaneously reproduced, a construction for outputting
the reproduced signals from separate output terminals
25 simultaneously and in parallel may be employed, parti-
cularly, in the case of an analog output, as a method
other than the construction in which the plurality of
reproduced signals are outputted in a time-division

1 multiplex form, as mentioned above. Though in the
above-mentioned example the reproduction signal is
outputted at a reproduction speed for a usual video
signal, the transmission rate of the reproduction signal
5 may be made higher than the reproduction speed for the
usual video signal in order to transmit the reproduction
signal to another system in an analog or digital signal
form at a high rate or to perform high-speed dubbing
which is one of effects of the present embodiment. This
10 can be realized in such a manner that the fundamental
operating speed of there producing system is set to be
higher than a normal reproduction speed and the operat-
ing speeds of the servo circuit 508, the reproduction
signal selection circuit 509 and the reproduction signal
15 processing circuit 510 are changed in accordance with
the number of multiple-recorded signals and/or the
number of signals to be outputted as a reproduction
signal with the above fundamental speed being the
standard. If the transmission rate of a reproduction
20 signal is made variable so that a rate adapted for a
transmission path to which the reproduction signal is to
be connected or the performance or function of a
recorder by which the reproduction signal is to be
recorded, can be selected.

25 As mentioned above, according to the present
embodiment, it is possible to simultaneously record any
number of signals selected from among a plurality of
signals in a multiplexed video signal and to reproduce

1 any number of signals from among the recorded signals at
any speed. Also, in the case where a plurality of
signals are selected and reproduced and the plurality of
reproduced signals are simultaneously outputted in a
5 time-division multiplex form or from separate output
terminals in parallel, it is possible to arbitrarily set
the transmission rate of an output signal.

The present embodiment has been explained in
conjunction with the case where the present invention is
10 applied to a helical-scan digital-recording VTR. It is
of course that a similar effect can be obtained in the
case where the present invention is applied to a fixed
head VTR. The fixed head system is convenient for the
structuring of a system since it has a higher degree of
15 freedom for the setting of the units of division of a
signal subjected to time-division multiple recording as
compared with the helical scan system. Also, it is of
course that the present invention is applicable to a
recording/reproducing equipment other than the VTR or is
20 applicable to a digital signal processing and analog
recording system.

The present invention can be applied to not
only the case where an input signal is time-division
multiplexed, as mentioned above, but also the case where
25 a plurality of signals are inputted simultaneously and
in parallel. In the latter case, the recording signal
selection circuit 503 is constructed to receive the
input signals in parallel.

1 As has been mentioned in the foregoing,
according to the present invention, it is possible to
realize a digital VTR in which high-speed recording onto
a tape can be made with the same format as that used in
5 standard-speed reproduction. Further, there can be
realized a transmission signal processing for trans-
mitting at a high rate a video signal to be recorded by
such a digital VTR. Also, in the case where a signal
transmitted from the transmission signal processing
10 system is to be recorded by a multiplicity of VTR's, it
is possible to designate those ones of the multiplicity
of VTR's by which recording is to be made and to make a
control of the start/stop of recording.